Wind Resource Considerations on Small Turbine Projects

Small Wind Systems Tutorial
Village Power Conference Workshop

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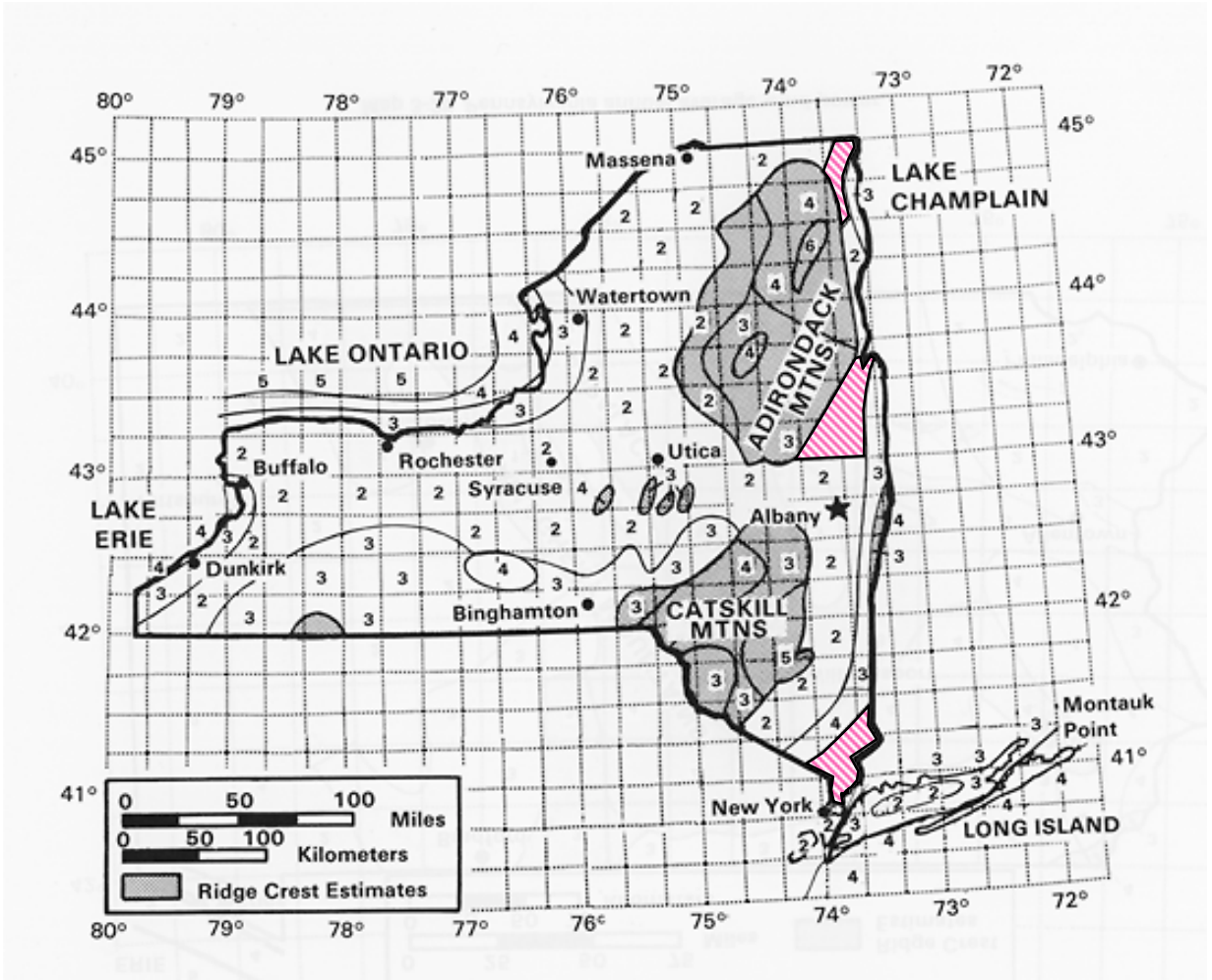
Part 5

Small Wind Works Nearly Everywhere

Example from New York State

Small Wind Needs Only a Class 2 Resource or Better

Class 1 Areas (> 4.4 m/s)



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General Rules 1

- Should Mistrust Meteorological Wind Data ... Assume it to be Bad, Until Proven Otherwise
- Meteorological Data Must be Screened for "Disappearing Wind" Phenomena

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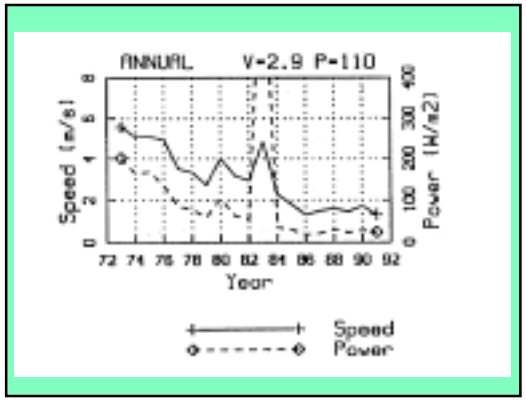
Legacy Data Wind Maps

The Curse of Meteorological Data

- **Sheltered Wind Sensors**
  - **Below Trees, Buildings, Etc.**
  - **Roof Mounted**
- **Worn Bearings, No Calibrations, Etc. Leads to "Disappearing Wind"**

Most National Wind Maps Radically Under-Estimate Available Wind Energy Resources !



Case of "Disappearing Wind"
Kupang, Indonesia

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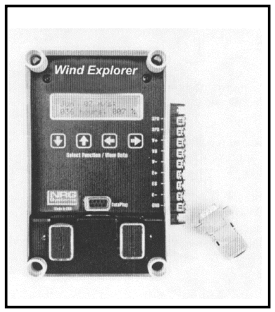
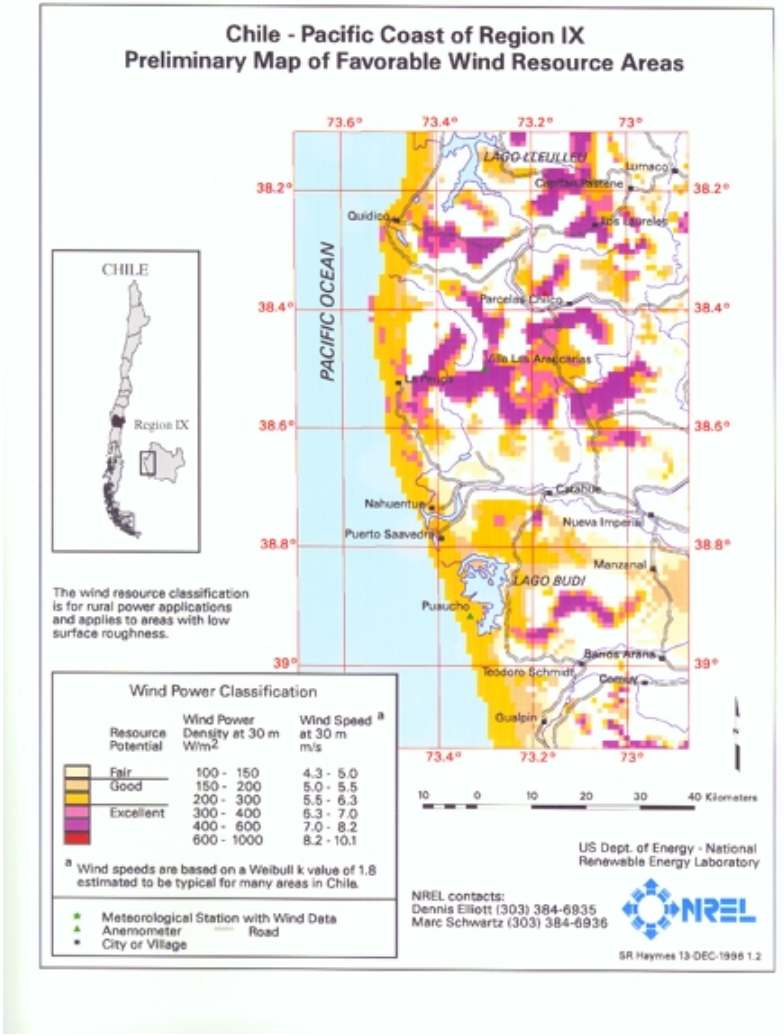
Finding the True Wind Resource

- **US-DOE / NREL Wind Mapping with Additional Data Sources: Satellite, Ex-Military Data, Etc.**
- **Private Companies Now Active in New Mapping**
- **New Low Cost Wind Loggers Specifically Designed for Small Wind Applications are Now Available**

Wind Explorer
NRG Systems





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General Rules 2

- Recognize That the Daily, Monthly, and Annual Variations in Wind Resources are Significant, So Resource Assessment Can Never be an Exact Science
- Best Estimates of Resources, Based on Best Available Data, are Often Sufficient ... Particularly When a Back-up Generator is Involved
- As Projects are Developed, Area Wind Resources Will Become Better Understood ... An Important Benefit of Pilot Projects
- Short Term Monitoring is a Useful Method in the Design Phase

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General Rules 3

- Use Annual Average Wind Speed for Preliminary Design
- Use Monthly Average Wind Speeds for Final Design
- Shear Exponents Should be Carefully Chosen ... Always Estimated
- Focus on Critical Month(s) … Low Wind or High Load

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General Rules 4

- Series Wind Data (eg, Hourly Averages for 3 Months) is of Academic Interest Only ... Not Very Useful in the Design Process
- Diurnal Characteristics and Weibull K's are Useful in Battery Bank Sizing Considerations
- Wind Direction Information is Generally Not Very Useful, Except in Complex Terrain, Sheltering Situations or When Multiple Turbines Must be Installed at a Site
- Turbulence Intensity Could be Useful if Better Understood … Ignore it

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Sources of Wind Data for Design

- Actual Site Monitoring is Always the Best, But is Seldom a Viable Option due to Cost and Time
- Short Term Monitoring (3-6 Months) With Extrapolation from Meteorological Data is Effective
- U.S. Dept. of Energy World Wind Map (1982) is a Good Place to Start
- Obtain Available Meteorological / Historical Wind Data for Nearby Sites ... This Will Often Form the Basis for an “Informed Estimate”

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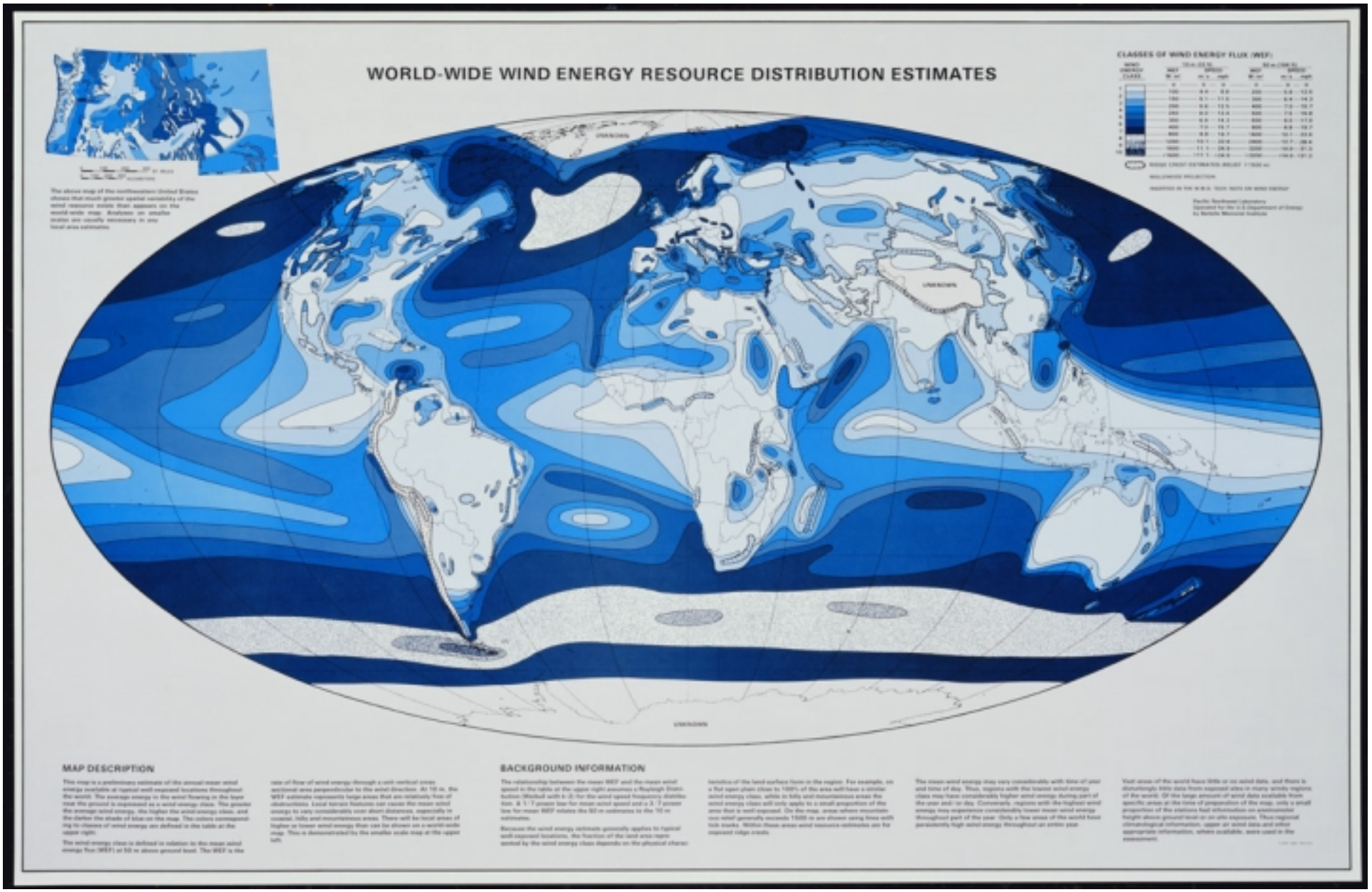
U.S. DOE World Wind Map



Sources of Wind Data for Design

- Use New Wind Maps where Available
- Obtain Available Meteorological / Historical Wind Data for Nearby Sites ... This Will Often Form the Basis for an "Informed Estimate"
- If Met. Data Shows V < 2.5 m/s, Should Look at Upper Air Data
- Ship Data Can be Helpful in Coastal and Island Situations
- Turbine Manufacturers can Help with Resource Analysis

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NOAA Wind Data on the Internet

in knots, daily mean values

- Go to http://www.ncdc.noaa.gov/cgi-bin/res40.pl?page=gsod.html
- Click on “Get/View Data”
- Scroll down to the “CLIMVIS” (Climate Visualization) link and click.
- Click on “Global Summary of the Day (12 Weather Elements)” Time Series link
- Click “I Agree” to the NOAA Res 40 terms
- Select “one parameter for specified time frame” and select region from map.
- Select country
- Select data collection station
- Select “mean wind speed” parameter
- Select a range of one year
- Click “Submit Graph Values”
- After graph has downloaded, click “download data file”
- Cut and paste data into spreadsheet to compile into monthly averages (paste as unicode text in MS Excel)

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NASA Solar Data on the Internet

- Go to http://eosweb.larc.nasa.gov/sse/
- Click on Meteorology and Solar Energy
- Follow instructions for data retrieval.

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